

1. A method of eliminating volcano effect in dual damascene comprising the steps of:

3 providing a substrate having first and second insulative layers, optionally separated from each other by an
6 intervening etch-stop layer formed thereon said substrate;

9 forming a hole opening through said first and second insulative layers;

12 forming a fill material over said substrate, including in said hole opening;

15 removing any excess fill material over said hole opening;

18 forming a trench opening in said second insulative layer over said hole opening in said first insulative layer, thus completing the forming of said dual damascene structure on said substrate;

21 removing said fill material from said hole opening;

depositing metal in said dual damascene structure; and

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removing excess metal to complete the forming of said dual damascene without the volcano effect.

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2. The method of claim 1, wherein said substrate is silicon.

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3. The method of claim 1, wherein said first insulative layer is a low-k dielectric having a dielectric constant between about 2.2 to 3.5.

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4. The method of claim 1, wherein said first insulative layer has a thickness between about 1000 to 10000 Å.

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5. The method of claim 1, wherein said optional intervening etch-stop layer is silicon nitride.

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6. The method of claim 1, wherein said second insulative layer is a low-k dielectric having a dielectric constant between about 2.5 to 3.5.

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7. The method of claim 1, wherein said second insulative layer has a thickness between about 1000 to 10000 Å.

8. The method of claim 1, wherein said fill material comprises I-LINE PR.

9. The method of claim 1, wherein said fill material comprises spin-on organic oxide such as SiLK or FLARE.

10. The method of claim 1, wherein said removing said excess fill material is accomplished by chemical mechanical polishing (CMP), or by etching.

11. The method of claim 1, wherein said metal comprises copper.

12. The method of claim 1, wherein said metal has a thickness between about 1000 to 15000 Å.

13. The method of claim 1, wherein said removing said excess metal is accomplished by chemical mechanical polishing (CMP).

14. A method of eliminating volcano effect in dual damascene comprising the steps of:

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providing a substrate having a passivation layer formed over a first metal layer formed on said substrate;

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forming a first insulative layer over said substrate;

9 forming an optional etch-stop layer over said first insulative layer;

12 forming a second insulative layer over said etch-stop layer;

15 forming a first photoresist layer over said second insulative layer and patterning said photoresist to form a first photoresist mask having a hole pattern;

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etching said first and second insulative layers, including said optional etch-stop layer through said hole pattern to

21 form a hole reaching said passivation layer;

removing said first photoresist mask;

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forming a fill material over said substrate, including in said hole opening;

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removing any excess fill material over said hole opening;

30 forming a second photoresist layer over said substrate,
including said hole opening and patterning said second
photoresist to form a second photoresist mask having a
33 trench pattern;

etching said second insulative layer through said trench
36 pattern in said second photoresist mask to form a trench in
said second insulative layer, thus completing the forming
of said dual damascene structure in said substrate ;

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removing said second photoresist mask;

42 removing said fill material from said hole opening;

depositing a second metal in said dual damascene structure;

45 and

removing excess metal to complete the forming of said dual
48 damascene without the volcano effect.

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15. The method of claim 14, wherein said substrate is silicon.

16. The method of claim 14, wherein said first metal is copper.

17. The method of claim 14, wherein said first insulative layer is a low-k dielectric having a dielectric constant between about 2.2 to 3.5.

18. The method of claim 14, wherein said first insulative layer has a thickness between about 1000 to 10000 Å.

19. The method of claim 14, wherein said optional etch-stop layer is silicon nitride.

20. The method of claim 14, wherein said second insulative layer is a low-k dielectric having a dielectric constant between about 2.2 to 3.5.

21. The method of claim 14, wherein said second insulative layer has a thickness between about 1000 to 10000 Å.

22. The method of claim 14, wherein said fill material comprises i-line PR.

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23. The method of claim 1, wherein said fill material is spin-on organic oxide, such as SiLK or FLARE.

24. The method of claim 14, wherein said removing said excess fill material is accomplished by chemical mechanical polishing (CMP).

25. The method of claim 14, wherein said second metal comprises copper.

26. The method of claim 14, wherein said second metal has a thickness between about 1000 to 15000 Å.

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27. The method of claim 14, wherein said removing said excess metal is accomplished by chemical mechanical polishing (CMP).

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